# The Time Course of Age-Related Preferences Toward Positive and Negative Stimuli

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**When and why do older adults show positive preferences in their gaze patterns, looking preferentially toward positive and away from some negative stimuli? The current study investigated the time course of older adults' preferential fixation toward positive (happy) stimuli and away from negative (angry) stimuli to discern whether such patterns are more consistent with cognitive control or with simplified processing accounts of their origins. Positive preferences in older adults were found to emerge only 500 ms and later after stimulus onset and increased linearly over time; this time course is consistent with a cognitive control account.**

**Key Words:** Cognitive control—Eye tracking—Positivity.

OLDER adults show gaze preferences toward positive and away from negative stimuli (Isaacowitz, Wadlinger, Goren, & Wilson, 2006a, 2006b); findings of both age-related "positive engagement" and "negative avoidance" have been interpreted as reflecting older adults' motivation to regulate their emotions and optimize their current feeling state. As the social environment contains some mood-damaging information and other information that might improve mood, it is a logical strategy to "look positive" at the world if the goal is to feel good. According to socioemotional selectivity theory, older adults are motivated by shifts in time perspective to optimize their affect, and positivity effects in information processing serve this goal (Carstensen, Isaacowitz, & Charles, 1999; Carstensen & Mikels, 2005). Such positivity stands in contrast to evidence that humans generally show preferential processing for negative material (e.g., Rozin & Royzman, 2001).

Can motivation actually influence gaze? Several approaches tested whether motivation could plausibly cause gaze preferences displayed by older adults. Because a primary competing hypothesis involves simple age differences in cognitive or perceptual abilities, one approach has been to test young adults whose age (and therefore cognitive and perceptual functioning) is comparable but whose motivation varies. We first investigated gaze in college freshmen and seniors (Pruzan & Isaacowitz, 2006). Graduating college seniors, who presumably share the limited time perspective and motivation to optimize affect of older adults, looked less at negative faces than did first-year students, demonstrating negative avoidance. However, no evidence for positive engagement among the college seniors was found.

In a second study, we randomly assigned young adults to one of three motivational conditions: regulate emotions, gain information, or control. The regulation group, manipulated to the presumed motivational state of older adults, showed negative avoidance in their gaze, but no positive engagement (Xing & Isaacowitz, 2006). Thus, in

two studies, manipulating motivation caused a reduction in gaze toward negative stimuli but not an increase in gaze toward positive stimuli, providing some evidence that motivational manipulations could partially explain older adults' gaze patterns. Questions remain, however, about if and how motivation could be the underlying mechanism leading to the generally positive gaze patterns shown by older individuals.

*Two Theoretical Perspectives on Positive Preferences: Cognitive Control Versus Simplified Processing*

Mather and colleagues (e.g., Knight et al., 2007) have recently argued that for older adults to display positive preferences in their information processing, they need to have adequate cognitive control (the "cognitive control" account). Thus, only those participants with enough cognitive control are actually able to override the usual tendency to focus on the negative (e.g., Rozin & Royzman, 2001) and instead focus on the positive. As this account views positive preferences as a "top-down" interference with the normal (negative) response to such stimuli, the time course should matter: presumably, the more automatic negative preference should set in immediately, followed later by a controlled shift toward the positive.

In contrast, others have argued that older adults may show positive preferences not as a way to achieve mood-regulatory goals but rather to simplify their information processing (the "simplified processing" account). For example, Labouvie-Vief, Diehl, Jain, and Zhang (2007) found that older adults displayed high levels of affect optimization, related to their desire to feel good, but relatively lower levels of affect complexity. This finding led the authors to conclude that older adults' desire to optimize their affect may be a compensatory tool to deal with declining complexity. Relatedly, Consedine, Magai, and Bonnano (2002) argue that older adults use positive affective orientation to

compensate for declining somatic systems and resources. From these perspectives, positive preferences should result from worsened cognitive and physical functioning. If positivity is a generic response by a challenged system, and is not superimposed on existing negative responses, it should be time course invariant and should emerge immediately upon stimulus onset.

Thus, the cognitive control and simplified processing approaches differ in hypothesized time course of positive preferences. The current study examined these divergent perspectives to attempt to understand the sources of older adults' positive enhancement in gaze. Finding that positive preferences in gaze do not emerge immediately after stimulus onset (but happen later and increase over time) would support the cognitive control account. In contrast, time-invariant preference patterns would support the simplified processing account. Distinguishing between these perspectives is important in clarifying what motivational processes do (and do not) lead older adults to show positive preferences in their gaze.

To provide a test of these perspectives, we conducted analyses of the time course of eye tracking data involving younger and older adults' fixation patterns to one positive (happy) and one negative (angry) emotional face type. We chose these emotional expressions because they showed age differences in our past work (e.g., Isaacowitz et al., 2006a, 2006b), and anger-related processing has shown age differences in other methods as well (e.g., Coats & Blanchard-Fields, 2008). The overall fixation patterns for these data were reported by Isaacowitz and colleagues (2006b), but fixation data in that paper were summed over the entire interval in which the stimulus was presented. For the current project, these data were decomposed into 500-ms intervals to discern more specifically when looking preferences emerged. Our rationale for using 500 ms as our cutoff is as follows: Although the specific time for delineating bottom-up versus top-down influences on vision may vary from study to study (cf. van Zoest, Donk, & Theeuwes, 2004; Fazio, Sanbonmatsu, & Powell, 1986), all studies suggest that bottom-up influences should happen rapidly. It has been proposed that biases at initial orienting should reveal themselves within 500 ms of stimulus onset (Mogg & Bradley, 1998); relatedly, a recent eye tracking study found that mean latencies to first fixation were on average between 400 and 490 ms for both emotional and nonemotional images (Nummenmaa, Hyönä, & Calvo, 2006). Although age-related slowing is ubiquitous in many cognitive processes, age-related slowing effects on control of eye movements are not as obvious (see, e.g., Cassavaugh, Kramer, & Peterson, 2004), making comparisons of equal time segments across age groups reasonable. We therefore believed that a 500-ms interval should be adequate in both age groups for delineating whether positive preferences emerge immediately and remain uniform or emerge relatively later after stimulus onset.

## METHODS

### Participants and Procedure

Data for these analyses were collected as part of the study by Isaacowitz and associates (2006b). Participants were 38 younger adults (30 women, 8 men) aged 18–21 years ($M = 18.38$, $SD = 0.72$) and 41 older adults (27 women, 14 men) aged 57–84 years ($M = 68.22$, $SD = 6.71$). Participants viewed synthetic faces that varied in emotional valence; in each trial, a neutral face was paired with an emotional face (happy, sad, afraid, or angry), although both faces were the same synthetic individual (see Isaacowitz et al., 2006b). Only happy–neutral and angry–neutral trials were used in the current analyses. Emotional faces were 7.7 × 10.2 cm and roughly 219 × 292 pixels. The stimulus pairs were presented on a 15-inch computer monitor, and participants were seated at eye level with the center of the screen. Participants viewed the stimulus pairs from a distance of 32 inches, and the pairs were displayed and viewed at 5.41° visual arc. Participants were asked to "look naturally" at the face pairs as their gaze patterns were recorded by an ASL 504 eye tracking system; trials were either 1, 4, or 8 s in length.

Data for four younger participants were not calculated due to numerous untrackable trials in their data, leaving 34 younger participants (89%) for analyses. Twelve older participants were untrackable due to hard contact lenses, reflective eyewear, or pupil obfuscation, leaving 29 older participants (71%) for analyses. Trackable older adults performed better on the backward digit span, $F(1, 39) = 6.24$, $p < .05$, and had higher accuracy scores on the attention-switching task for the experimental condition, $F(1, 30) = 4.99$, $p < .05$, than did their nontrackable age peers. No other differences emerged between trackable and untrackable older adults.

### Statistical Analysis

Raw gaze data were recorded by Eyenal; a data batching program (WinBatch) extracted individual fixations so that increasing half-second time increments could be assessed. Using fixation data on each of the two faces for each segment, a ratio score was computed as in the study by Isaacowitz and associates (2006a, 2006b): (emotional – neutral)/ (emotional + neutral). Percent of total fixation rather than raw duration was used to minimize the impact of momentary recording failures. Zero is the "even" point; a positive score indicates a preference toward happy or angry, and a negative score indicates a preference away from happy or angry. Ratios were calculated for each participant across all available trials. Because two-thirds of our trials had at least 4.0 s of data and only one-third had 8.0 s due to counterbalancing, we used only the first 4.0 s of data to maximize available trials. This left up to 38 happy–neutral trials and 37 angry–neutral trials available for the current analyses.

Table 1. Mean Ratio Scores to Happy–Neutral Face Pairs

| | Younger Participants | | | | | Older Participants | | | | | Between Groups | |
| Segment | $N$ | $M$ | $SD$ | One-Sample $t$ | $d$ | $N$ | $M$ | $SD$ | One-Sample $t$ | $d$ | $t$ | $d$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 34 | 0.01 | 0.15 | 0.42 | .07 | 29 | −0.04 | 0.13 | −1.61 | −.31 | 1.39 | .35 |
| 2 | 34 | −0.01 | 0.18 | −0.28 | −.06 | 29 | 0.08 | 0.20 | 2.10* | .40 | 1.79 | .48 |
| 3 | 34 | 0.08 | 0.34 | 1.42 | .24 | 29 | 0.01 | 0.31 | 0.18 | .03 | 0.88 | .21 |
| 4 | 34 | 0.09 | 0.35 | 1.47 | .26 | 29 | 0.15 | 0.44 | 1.89 | .34 | 0.66 | .15 |
| 5 | 34 | 0.14 | 0.34 | 2.35* | .41 | 29 | 0.17 | 0.31 | 2.87** | .55 | 0.38 | .09 |
| 6 | 34 | 0.04 | 0.32 | 0.73 | .13 | 29 | 0.10 | 0.34 | 1.57 | .29 | 0.70 | .18 |
| 7 | 34 | −0.07 | 0.37 | −1.14 | −.19 | 29 | 0.10 | 0.47 | 1.16 | .21 | 1.64 | .41 |
| 8 | 34 | −0.02 | 0.30 | −0.41 | −.07 | 29 | 0.22 | 0.39 | 2.99** | .56 | 2.73** | .70 |

*Note*: *$p$ < .05; **$p$ < .01.

Time segments (i.e., Segment 1, Segment 2) refer to consecutive half-second increments beginning immediately upon the onset of stimulus. Segment 1 refers to the presentation interval from 0.0 to 0.5 s after the stimulus is presented, Segment 2 to 0.5–1.0 s, and so on, up to Segment 8 (3.5–4.0 s). It is important to note that the trial duration varied randomly throughout the presentation of slides, so participants did not know on a particular trial if that trial would be shown for 1-, 4-, or 8-s total duration. Therefore, analyzing the first second of each trial (regardless of trial length) as well as the first 4 s regardless of duration is a reasonable way of analyzing the data given that participants could not have modulated their gaze in the early seconds differentially by stimulus length due to the trial-by-trial randomization.

## Results

### Time Course of Happy and Angry Face Gaze Preferences

Ratio scores to happy and angry faces by age group and time segment are shown in Tables 1 and 2. To examine whether overall preference patterns differed over time, across age and emotion type, we conducted a repeated-measures analysis of variance with age (young, old) as a between-subjects factor and emotion (happy, angry) and time segment (1–8) as within-subjects factors. A main effect of emotion emerged, $F(1, 60) = 3.90$, $p = .05$, $\eta^2 = .06$, suggesting that participants demonstrated a preference toward happy ($M = .06$) and away from angry ($M = −.02$) faces. Consistent with the overall results presented by Isaacowitz and associates (2006b), a significant Age × Emotion interaction emerged, $F(1, 60) = 5.45$, $p < .05$, $\eta^2 = .08$, indicating that younger adults showed a preference toward both happy ($M = .03$) and angry ($M = .05$) faces, whereas older adults showed a preference toward happy ($M = .10$) but away from angry ($M = −.08$) faces. This was, however, qualified by a significant Age × Emotion × Time Segment interaction, $F(7, 420) = 3.52$, $p < .01$, $\eta^2 = .06$.

In order to decompose this three-way interaction, within-group and between-group preference patterns were analyzed for each emotion across the various time segments (see Tables 1 and 2). One-sample $t$ tests showed that younger adults had only one significant preference toward happy faces at Segment 5 (2.0–2.5 s), $t(33) = 2.35$, $p < .05$, and did not demonstrate a significant preference toward angry faces at any time segment. Older adults displayed a significant preference toward happy faces in Segment 2 (0.5–1.0 s), $t(28) = 2.10$, $p < .05$; Segment 5 (2.0–2.5 s), $t(28) = 2.87$, $p < .01$; and Segment 8 (3.5–4.0 s), $t(28) = 2.99$, $p < .01$; and they showed a preference away from angry faces at Segment 7 (3.0–3.5 s), $t(26) = −2.39$, $p < .05$, and Segment 8, $t(26) = −2.13$, $p < .05$.

Between-group analyses revealed that older adults showed a greater preference toward happy faces at Segment 8, $t(61) = 2.73$, $p < .01$, and away from angry faces at Segment 6 (2.5–3.0 s), $t(55) = 2.56$, $p < .05$, and Segment 8, $t(55) = 2.87$, $p < .01$, as compared with the younger adults.

### Contrast Analyses

In order to test for changes in fixation preferences over time segments, we ran a series of contrast analyses.

*A priori analyses.*—Our original intent was to determine whether age-related emotional processing preferences emerged rapidly after stimulus onset (i.e., within the first 500 ms). Thus, the happy and angry Segment 1 preference scores, within each age group, were tested against the remaining seven time segments using contrast analyses (Rosenthal & Rosnow, 1991). Weights were assigned in a nonorthogonal fashion, with a weight of 7 assigned to Segment 1 preference scores and a weight of −1 assigned to the remaining time segments. Older adults' preference scores for happy faces at Segment 1 were significantly different from those of the remaining time segments, $t(224) = 2.32$, $p < .05$, $d = .31$. The Segment 1 preference scores were negative (i.e., older adults were orienting toward neutral faces) but later time segments showed generally positive scores (i.e., older adults were orienting toward happy faces). For younger adults, preference scores for happy faces at Segment 1 were not significantly different from the remaining time segments, $t(264) = −0.44$, $p = .66$, $d = .05$. The contrast analyses comparing Segment 1 to the remaining time segments for angry faces were not significant for either age group.

Table 2. Mean Ratio Scores to Angry–Neutral Face Pairs

| Segment | Younger Participants | | | | | Older Participants | | | | | Between Groups | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | M | SD | One-Sample t | d | N | M | SD | One-Sample t | d | t | d |
| 1 | 32 | 0.03 | 0.22 | 0.80 | .14 | 27 | 0.00 | 0.13 | 0.00 | .00 | 0.66 | .16 |
| 2 | 32 | −0.02 | 0.22 | −0.50 | −.09 | 27 | −0.05 | 0.22 | −1.18 | −.23 | 0.54 | .14 |
| 3 | 32 | 0.08 | 0.36 | 1.28 | .22 | 27 | −0.02 | 0.29 | −0.28 | −.07 | 1.12 | .30 |
| 4 | 32 | −0.01 | 0.37 | −0.16 | −.03 | 27 | −0.05 | 0.43 | −0.63 | −.12 | 0.39 | .10 |
| 5 | 32 | 0.02 | 0.39 | 0.24 | .05 | 27 | 0.01 | 0.43 | 0.12 | .02 | 0.06 | .02 |
| 6 | 32 | 0.12 | 0.42 | 1.57 | .29 | 27 | −0.18 | 0.46 | −2.00 | −.39 | 2.56* | .68 |
| 7 | 32 | 0.01 | 0.41 | 0.19 | .02 | 27 | −0.18 | 0.39 | −2.39* | −.46 | 1.85 | .47 |
| 8 | 32 | 0.11 | 0.34 | 1.86 | .32 | 27 | −0.17 | 0.42 | −2.13* | −.40 | 2.87** | .74 |

*Note*: $*p < .05$; $**p < .01$.

*Post hoc analyses.*—Linear contrasts were conducted to test whether preference scores changed over time, given our interest in exploring the nature of change in viewing patterns over the interval of stimulus presentation. Older adults' preference scores for both happy, $t(224) = 2.68$, $p < .01$, $d = .36$, and angry, $t(222) = 2.95$, $p < .01$, $d = .40$, faces were significant for a linear trend. These results suggested that older adults' fixation preferences *toward* happy and *away* from angry faces increased over time. None of the contrast analyses for younger adults revealed significant linear trends in fixation preference for either emotion.

## DISCUSSION

When and why do older adults show preferences toward the positive and away from the negative in their gaze toward emotional faces? The current study aimed to answer this question by exploring the time course and correlates of such positive gaze preferences. Whereas the cognitive control account argues that positive gaze preferences result from the exercise of mood-relevant goals, and therefore should require cognitive effort and take some time to emerge, the simplified processing account would posit no effect of time.

We found the time course of positive gaze preferences to be consistent with top-down effects, as they emerged relatively later in processing. In no case was there a preference in either age group "early" (i.e., within 500 ms after stimulus onset; see definition in Mogg & Bradley, 1998). Age-related preferences toward happy faces occurred at several points throughout the interval of stimulus presentation; however, they did not start until the second segment (500 ms after onset of the stimulus). Moreover, contrast analyses revealed that older adults tended to look more at neutral than happy faces during the first 500 ms and that the preference toward happy faces that emerged after 500 ms increased over time. Age-related preferences away from anger emerged only "late"—3 s and more—after stimulus onset; this pattern also showed a linear increase over time.

Thus, the time course analyses show a relatively clear pattern such that older adults' gaze preferences do not emerge immediately but happen soon thereafter (in the case of fixation to happy faces) or several seconds later (in the case of fixation to angry faces), with a linear increase in the magnitude of the preference over time. These patterns are consistent with the cognitive control account (e.g., Mather & Knight, 2005). No linear time effects were found in younger participants. One possible explanation for the finding that older adults' happy preference emerged temporally sooner than their preference away from anger is that it may require more cognitive control resources, and thus more time and effort, to override a natural proclivity to focus on the negative (e.g., Rozin & Royzman, 2001; see also Knight et al., 2007) than it does to engage more with the positive.

Although older adults showed a more consistent pattern of positive engagement, and in one segment showed significantly greater fixation to happy faces than did the young, it was also the case that the young adults tended to show either no preference or a slight preference toward happy as well. This pattern is consistent with recent meta-analytic findings that both young and older adults show a positive preference in attention, although it may be somewhat stronger in older adults (Murphy & Isaacowitz, 2008). Young adults did not show any preference in any segment toward or away from angry faces.

### LIMITATIONS AND CONCLUSIONS

Given previous findings suggesting that slowing may not entirely characterize age-related changes in control of eye movements (e.g., Cassavaugh et al., 2004), we elected to use similarly sized time segments for our older and younger participants. Although some studies of memory have tried to equate older and younger adults' performance by using different delays (e.g., Kensinger, Garoff-Eaton, & Schacter, 2007), it is simply not clear how one might use differential time segment length to attempt such matching for fixations. Two aspects of the current results further suggest that modifying segment length by age (using a longer segment for older adults because their eye movements may be slower) is not warranted. First, the earliest fixation preference was found in the older adults (in Segment 2); and second, the age difference in fixation for Segment 8 remained significant even after controlling for an individual difference measure of processing speed (backward counting). Thus, although the possibility that age-related slowing could

obscure the temporal pattern of fixation preferences should be noted as a limitation, future work that clearly delineated the nature of such slowing would be needed before any transformation factor could be used to correct for it.

Several other limitations of the current study should be noted. First, data in Tables 1 and 2 indicate that the fixation ratios showed greater variability in the later time segments than in the earlier ones. This is likely not surprising given that the stimuli remained stable during the entire interval, so gaze would be expected to "jump around" more after initial scanning. Also, if older adults are motivated to enhance positivity, one possible interpretation of our results is that they achieved only limited success: There was after all only one significant difference between older and younger adults in fixation to happy faces (Segment 8). However, only further research will reveal whether older adults are trying harder or are less successful than younger adults in regulating attention toward emotional information.

Why, then, do older adults show positive engagement in their emotional gaze? The time course is compatible with top-down influence: It appears that older adults' positive gaze preferences emerge rapidly but not immediately after the onset of emotional stimuli. Although consistent with the cognitive control account (Mather & Knight, 2005), much remains to be known about what processes are unfolding during this time course. It could be that executive processes are working to override negative tendencies and direct focus on positive material. Discerning the time course is one step toward isolating the real-time processes that help older adults regulate their mood.

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REFERENCES

Carstensen, L. L., Isaacowitz, D., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American Psychologist*, *54*, 165–181.

Carstensen, L. L., & Mikels, J. A. (2005). At the intersection of emotion and cognition: Aging and the positivity effect. *Current Directions in Psychological Science*, *14*, 117–121.

Cassavaugh, N., Kramer, A. F., & Peterson, M. S. (2004). Aging and the strategic control of the fixation offset effect. *Psychology and Aging*, *19*, 357–361.

Coats, A. H., & Blanchard-Fields, F. (2008). Emotion regulation in interpersonal problems: The role of cognitive-emotional complexity, emotion regulation goals, and expressivity. *Psychology and Aging*, *23*, 39–51.

Consedine, N. S., Magai, C., & Bonanno, G. A. (2002). Moderators of the emotion-inhibition health relationship: A review and research agenda. *Review of General Psychology*, *6*, 204–228.

Fazio, R. H., Sanbonmatsu, D. M., & Powell, M. C. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology*, *50*, 229–238.

Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006a). Is there an age-related positivity effect in visual attention? A comparison of two methodologies. *Emotion*, *6*, 511–516.

Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006b). Selective preference in visual fixation away from negative images in old age? An eye-tracking study. *Psychology and Aging*, *21*, 40–48.

Kensinger, E. A., Garoff-Eaton, R. J., & Schacter, D. L. (2007). Effects of emotion and memory specificity in young and older adults. *Journals of Gerontology: Psychological Sciences*, *62*, P208–P215.

Knight, M., Seymour, T. L., Gaunt, J. T., Baker, C., Nesmith, K., & Mather, M. (2007). Aging and goal-directed emotional attention: Distraction reverses emotional biases. *Emotion*, *7*, 705–714.

Labouvie-Vief, G., Diehl, M., Jain, E., & Zhang, F. (2007). Six-year change in affect optimization and affect complexity across the adult life span: A further examination. *Psychology and Aging*, *22*, 738–751.

Mather, M., & Knight, M. (2005). Goal-directed memory: The role of cognitive control in older adults' emotional memory. *Psychology and Aging*, *20*, 554–570.

Mogg, K., & Bradley, B. P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy*, *36*, 809–848.

Murphy, N. A., & Isaacowitz, D. M. (2008). Preferences for emotional information in older and younger adults: A meta-analysis of memory and attention tasks. *Psychology and Aging*, *23*, 263–286.

Nummenmaa, L., Hyönä, J., & Calvo, M. G. (2006). Eye movement assessment of selective attentional capture by emotional pictures. *Emotion*, *6*, 257–268.

Pruzan, K., & Isaacowitz, D. M. (2006). An attentional application of socioemotional selectivity theory in college students. *Social Development*, *15*, 326–338.

Rosenthal, R., & Rosnow, R. L. (1991). *Essentials of behavioral research: Methods and data analysis* (2nd ed.). Boston: McGraw Hill.

Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, *5*, 296–320.

van Zoest, W., Donk, M., & Theeuwes, J. (2004). The role of stimulus-driven and goal-driven control in saccadic visual selection. *Journal of Experimental Psychology: Human Perception and Performance*, *30*, 746–759.

Xing, C., & Isaacowitz, D. M. (2006). Aiming at happiness: How motivation affects attention to and memory for emotional images. *Motivation and Emotion*, *30*, 249–256.